

# Enhancing library impact through technology\*

DOI: <http://dx.doi.org/10.3163/1536-5050.103.4.015>

## INTRODUCTION

Technology continues to be a powerful driver of deep and sweeping changes in health sciences libraries. At the same time, libraries are facing unprecedented challenges due to massive cuts in public spending and increased requirements for accountability and transparency. In this environment, librarians need to think more strategically about technology and to look at how it can offer energizing possibilities and solutions to address these challenges. Technology provides the chance for librarians to innovate, boost quality, measure success, and align services with the priorities of their organizations. With technology, librarians can reintroduce themselves as visible, valuable, and essential partners in achieving common goals. This is especially important in the context of today's tight funding climate and the never-ending struggle to advocate for and secure necessary funding and support for libraries.

The seven virtual projects featured in this year's column have been selected by a panel of experts and are real-life examples of how health sciences librarians have implemented new technologies or applications to elevate their impact and take library services to the next level. Each report provides a brief narrative description of the project, technical background information, and a contact person for readers who would like to follow up for more information.

While consumer-oriented, social media technologies have become ever present and widely used, they continue to evolve and can be quite adaptable to use as discovery and dissemination tools. Librarians at the National Center for Child

Traumatic Stress Network describe one such project that uses Pinterest to build, curate, and disseminate resources on children's mental health after discovering with web analytics that their fellow community members were currently using this platform in their every day jobs. With a shift to mobile content consumption, library users expect access to library resources anytime and anywhere. The vital role that librarians play in providing ubiquitous and mobile information access is highlighted in the report on the Response and Recovery App in Washington (RRAIN), a collaborative project spearheaded by the University of Washington Health Sciences Library that created a mobile-optimized website and mobile app to support disaster response and recovery outreach for first responders and emergency management communities in the state of Washington.

Health sciences libraries continue to make headway in delivering library services closer to user workflows. Successfully embedding digital reference services into clinical workflows is the focus of a report offered by two tenacious hospital librarians, who describe the deployment of an "Ask-a-Librarian" button within their hospital's electronic health record (EHR) system as a natural outcome of years of determined effort to build strong relationships and promote the value of library services.

New government regulation and calls for accountability in research have prompted libraries to explore new approaches to assist users who increasingly need to demonstrate evidence of their research impact. Collaborating with researchers to assess their publication productivity and scholarly impact is in the current wheelhouse of services that librarians offer, yet the report from the Galter Health Sciences Library goes a step farther and illustrates how librarians have amplified this role by providing a new service model that uses more robust and comprehensive indicators of research impact and visualization tools to quantify, document, and communicate biomedical research impact.

The assessment movement has huge implications for health sciences libraries, too, as they need to show institutional relevancy and value in clear, measurable ways. The University of Virginia

\* Material for this column is selected with the assistance of the *Journal of the Medical Library Association* Virtual Projects Column Advisory Committee: Patricia F. Anderson, Taubman Health Sciences Library, University of Michigan; Kimberly Barker, Claude Moore Health Sciences Library, University of Virginia; Janis F. Brown, AHIP, Norris Medical Library, University of Southern California; Michelle Kraft, AHIP, Cleveland Clinic Alumni Library, Cleveland Clinic; and Elizabeth C. Whipple, AHIP, Ruth Lilly Medical Library, Indiana University.



Supplemental Figure 4 is available with the online version of this journal.

provides a detailed description of a unique library analytics tool that was built using a combination of technologies and aligns library assessment data with institutional strategic goals.

Access to data from scientific research is increasingly seen as central to the research process and to generating new discoveries and innovations. To address the challenges surrounding data management and reuse, the New York University (NYU) Health Sciences Library reports on an exciting new initiative to create a discipline-focused, open-source data catalog that gives users quick and easy access to large external data collections, as well as internal datasets generated by researchers at their institution.

Finally, for the second year in a row, the column features makerspaces with three-dimensional (3D) printing tools in library settings, spotlighting a stunning report by the librarians at Nova Southeastern University who describe how its new 3D printing service has directly inspired and catalyzed medical innovation and research at their institution, including printing prosthetic hands for children in need, inner ear models for use in audiology classes, and skulls and mandibles for use by surgery residents for trauma and facial reconstruction.

These virtual projects are quite simply amazing examples of librarian creativity, resourcefulness, and reinvention. Ultimately, they tell the story of librarians trying new approaches that disrupt library business as usual and demonstrate that libraries are worth investing in and worth using. Please consider sharing your own high-impact virtual project in future columns to embolden and encourage your colleagues. Submission, suggestions, and questions should be directed to Susan Lessick, AHIP, FMLA, at [slessick@uci.edu](mailto:slessick@uci.edu).

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## USING PINTEREST FOR HEALTH INFORMATION DISSEMINATION

**Submitted by Nathalie Reid, MLIS, MA, National Center for Child Traumatic Stress, University of California–Los Angeles (UCLA)**

The mission of the National Center for Child Traumatic Stress Network (NCTSN) is to develop

and disseminate resources on children's mental health. Since NCTSN was established by Congress in 2000, national experts in children's mental health have produced hundreds of resources for children, families, and communities in print and digital formats that are available on the NCTSN website <<http://www.nctsn.org>>. In an effort to expand access to these web resources, the NCTSN librarians developed new strategies for accessing this critical information, especially in an age of social media. Because the main audience for these resources are mental health professionals and parents or caregivers, the librarians sought out a platform with established use by these groups that was visually appealing, had successful user experience design, and had an effective user interface that made the site easily searchable.

Pinterest <<http://www.pinterest.com>>, an online pinboard for sharing and organizing images, was selected as the curation tool when the librarians discovered through Google Analytics that significant traffic was being directed from Pinterest to the NCTSN website. This illustrated that the Pinterest platform was already of interest to the NCTSN audience. Once the librarians discovered that users were currently using Pinterest to feature NCTSN resources, they created a Pinterest account and website <<http://www.pinterest.com/NCTSN/>>, developed content for all NCTSN resources, marketed the website, and monitored website traffic. Currently, the NCTSN Pinterest page has over 400 pins across 21 subject-related boards (e.g., domestic violence resources, juvenile justice resources, complex trauma, etc.).

As the developers and managers of the Pinterest account, the librarians create metadata for the "pins," including images of the resources, titles, descriptions, and uniform resource locator (URL) links. This content is then turned into categories and subcategories by Pinterest's search engine, which allows users to tailor their searches and find NCTSN resources. When the librarians began developing content for Pinterest, NCTSN resources were organized by subject topics based on established categories from the NCTSN website. These categories, called "boards" in Pinterest, provided curated reading lists and digital access to the resources. NCTSN content has evolved since the Pinterest website was launched because other "pinners" have added and shared their "pinnable" content by using a web browser plugin <<http://about.pinterest.com/en/goodies>> that further disseminates NCTSN resources.

The NCTSN Pinterest page has built an interactive and engaging way to explore children's mental health resources that will continue to be developed by the librarians. Future content will include "boards" that showcase learning-related infographics and feature lists of "Resources Worth Sharing" and "Top Ten Lists." The launch of the Pinterest page was highly anticipated by our network experts who were already actively using the site for professional research. Their support for the platform and the site will ensure continued enthusiasm for the project. The librarians will continue to track usage with Google Analytics, but the project is still too new to evaluate. Once the project has been evaluated, the librarians will produce a set of best practices for using Pinterest in medical library and information center settings.

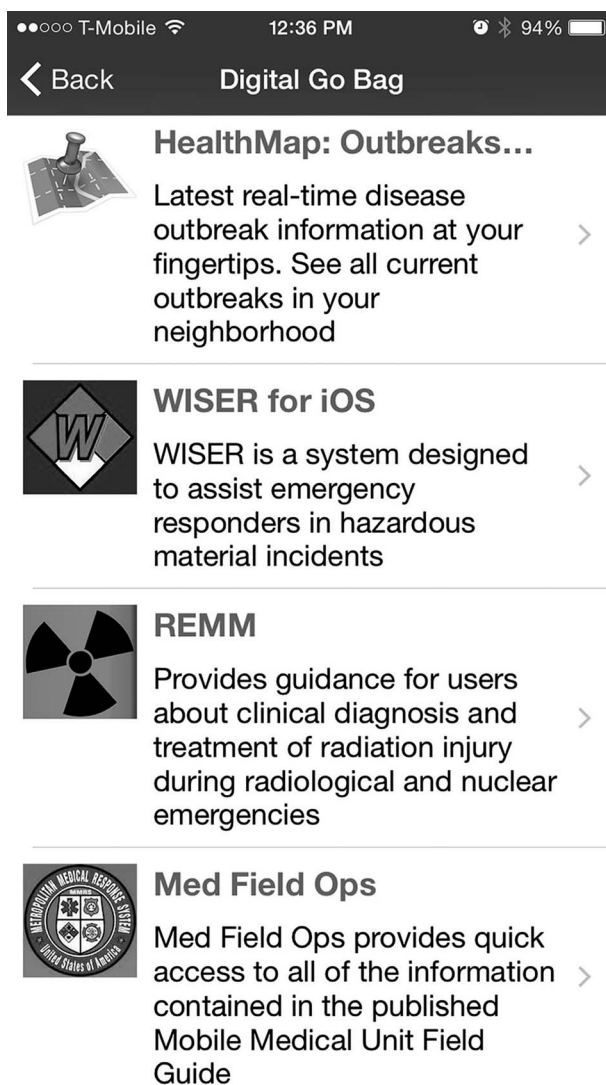
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### CREATING THE RESPONSE AND RECOVERY APP IN WASHINGTON: A STATEWIDE DISASTER INFORMATION PARTNERSHIP†

Submitted by Tania P. Bardyn, MLIS, AHIP, National Network of Libraries of Medicine, Pacific Northwest Region, University of Washington; Adam Garrett, National Network of Libraries of Medicine, Pacific Northwest Region; Kerry Kirk, MS, University of Washington; Gail Kouame, MLIS, University of Washington; Jamie M. Gray, MLS, AHIP, University of Washington; Emily J. Glenn, MSLS, AHIP, National Network of Libraries of Medicine, Pacific Northwest Region

The Response and Recovery App in Washington (RRAIN Washington) <<http://rrain.org>> facilitates mobile access to National Library of Medicine (NLM) disaster and emergency information resources alongside vetted national and state disaster information resources, including the Washington State Comprehensive Disaster Information Management Plan and situational awareness resources.

† This project was partially supported by a Disaster Health Information Outreach and Collaboration Project Award from the National Library of Medicine, contract no. HHS-N-276-2014-00658-P.



**Figure 1**  
Response and Recovery App in Washington (RRAIN Washington)  
Digital Go Bag

The RRAIN Washington project was conceived at the University of Washington Health Sciences Library within one year of two significant disaster events in central Washington State: a major, deadly landslide and a cluster of destructive summer wildfires. Local librarians' interest in disaster outreach was piqued when the library hosted NLM Disaster Information Specialist Program training in conjunction with MLA '12. The library received Disaster Health Information Outreach and Collaboration Project funding from the NLM Disaster Information Management Research Center to develop an iOS mobile app to support disaster response and recovery outreach and include links to other downloadable apps that can be accessed with or without an Internet connection (Figure 1).



This app is the first to offer Washington state-specific emergency information and is the first app developed at the University of Washington Libraries.

The project team collaborated with leaders from the Washington State Department of Health, Office of Emergency Preparedness and Response, and National Network of Libraries of Medicine (NN/LM) Pacific Northwest Region to assemble preliminary content. A focus group of first responders provided valuable input on situational awareness and emergency health information resources, discussed information needs at different stages of disaster response, and shared ideas for placement of resources within the app. The first responders identified a need for a website, in addition to an iOS app, that would be responsive for use across all mobile devices. Incorporating feedback from the focus group, librarians modified content and then worked with a web developer to create a responsive website. Using programming services from a commercial provider, they created an iOS mobile app, modeled after the website. This app was subsequently tested via Apple's TestFlight system. The University of Washington's innovation and commercialization center, CoMotion <<http://comotion.uw.edu>>, advised on mobile app ownership, licensing, and deployment. Library systems staff enrolled in the Apple Developer Program and used iOS developer tools to submit the app to the Apple Store.

The primary target audience of emergency responders, disaster managers, hospital personnel, public health workers, and librarians or information specialists was reached through four in-person, train-the-trainer workshops, led by project team librarians. Workshops included an overview of the project, website and mobile app demonstrations, a tabletop disaster scenario exercise, a debriefing, and a question-and-answer period. Training evaluations assessed participants' knowledge of relevant resources and tools.

RRAIN Washington promotes new and creative state-university collaborations on disaster health information needs. With project team expertise and strong existing relationships with community partners, libraries can lead similar projects. Impact of the project is being measured by the number of uses and downloads of the mobile app from the Apple Store, number of requests to update content, and number of first responders trained. Next stages of the project might include development of an Android-based app and inclusion of additional resources.

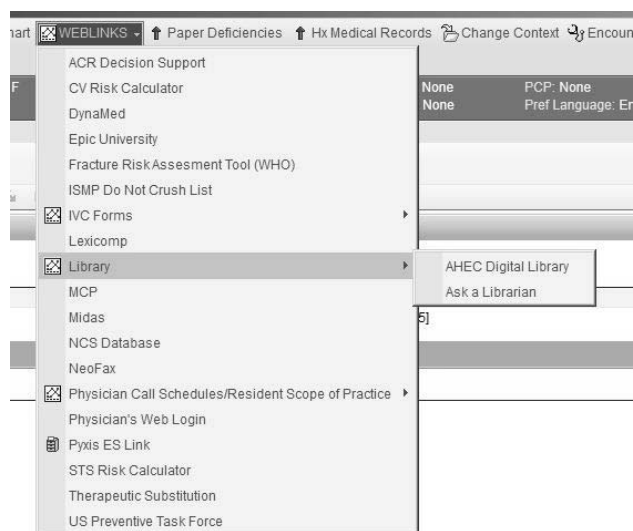
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## IMPLEMENTING ASK-A-LIBRARIAN TECHNOLOGY IN THE ELECTRONIC MEDICAL RECORD

**Submitted by Allison P. Matthews, MLS; Donna B. Flake, MSLS, MSAS, AHIP; New Hanover Regional Medical Center**

While digital reference services have become standard practice in many libraries today, digital reference services in hospital libraries are less common. In April 2014, an "Ask-A-Librarian" button was embedded inside the electronic medical record (EMR) from EPIC at the New Hanover Regional Medical Center (NHRMC) <<http://www.nhrmc.org>>, a 769-bed teaching hospital located in southeastern North Carolina. This feature has made it much easier for health professionals, while working with EPIC, to request information from the library as users no longer need to remember librarians' names, email addresses, or telephone numbers. This digital reference service is a complement to the array of services that we offer to health care providers in our physical library, staffed by two librarians and one library technical assistant.

Users can access the Ask-A-Librarian button from the EPIC toolbar by clicking the heading titled "WEBLINKS," which has a drop-down menu with links to external sources, including a heading for "Library" (Figure 2). When users hover over this heading, a menu is displayed for the Area Health Education Center (AHEC) Digital Library and the Ask-A-Librarian button. The AHEC Digital Library is our electronic library collection consisting of books, journals, and databases. By clicking on the Ask-A-Librarian button, users are directed to a web form where reference questions can be submitted to the librarians (Figure 3). With the help of NHRMC's Information Services (IS) Department, the uniform resource locator (URL) for this form was embedded in an "activity record" in EPIC, and the activity record was then added to a menu of available links that can be accessed directly from the EMR. There is virtually no difficulty in maintaining this link; however, should the URL for the web form change, we would need to update the link in EPIC.



**Figure 2**

The “WEBLINKS” heading and subsequent drop-down menu highlighting the library resources

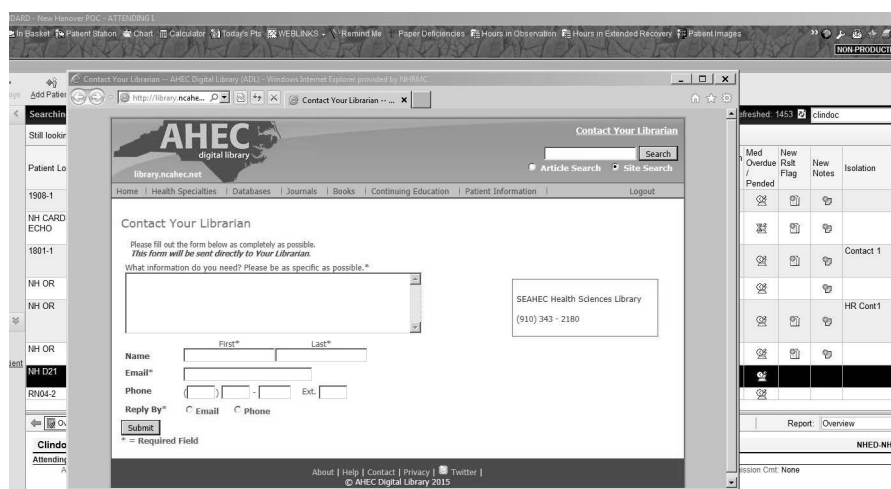
Adding the Ask-A-Librarian button is the outcome of many years work: demonstrating the value and breadth of library resources to NHRMC’s administrators and health care providers; building relationships with key departments and committees that would help with this endeavor, such as the IS Department and the nursing research and patient safety committees; and advocating for the inclusion of the AHEC Digital Library, in its entirety, in the medical record. The library was successful in embedding the AHEC Digital Library in the prior EMR from McKesson, so when planning for the new EPIC EMR, we were almost certain that our library

resources would remain accessible. We had already demonstrated the value of having the resources in the EMR, and we had users endorsing the inclusion of these resources.

The next step was for the library to advocate for an easy mechanism for contacting the librarians when health care providers who were actively using the EMR had questions for the library. The librarians and the IS Department brainstormed for many hours, and we decided that since the AHEC Digital Library already had a web form created for submitting reference questions to the library, a direct link to this form could be provided in EPIC. All questions submitted through this web form are delivered to the library’s email inbox.

In the last year, the Ask-A-Librarian button in the EMR has produced a 33% increase in requests to the library. The AHEC Digital Library continues to show growth, and access to this resource through the EMR has steadily grown from 1,695 hits in 2008 to 13,186 hits in 2014 (Figure 4, online only). The button increases the library’s visibility in our busy health care community and is a reminder that librarians can assist in the care of patients by providing research and articles. One of our third-year residents said it best: “The ‘Ask-A-Librarian’ button is a great resource for clinicians. I believe this should be the gold standard in the age of EMRs,” and we could not agree more.

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**Figure 3**

The web form used to contact the librarians

## VISUALIZING RESEARCH IMPACT: PROVIDING SERVICES AND SUPPORT

Submitted by Karen E. Gutzman, MA, MS; Kristi L. Holmes, PhD; Donald M. Lloyd-Jones, MD; Northwestern University

In early 2014, Northwestern University's Galter Health Sciences Library began implementing a cohesive set of services around research evaluation and impact assessment through the newly formed Metrics and Impact Core (MIC) <<http://galter.northwestern.edu/Request-Services-and-Materials/metrics-and-impact-core-mic>>. The new services are complementary to the expertise and data already available from the library. Many of these services use bibliographic data, since it can be mined and visualized using a variety of techniques to gain a better understanding of research impact. Our library's unique position within Northwestern University's Clinical and Translational Sciences Institute has provided us with opportunities to promote and implement our new services.

Currently, we are working on operationalizing our workflow, and to this end, we have developed templates for publication summaries at a research-group level and individual-researcher level, which include both bibliographic data and visualizations. We have received numerous requests for summaries and have delivered eight in the past two months. Additionally, we are working on utilizing the vast trove of outputs and indicators from the Becker Model for Assessing Research Impact <<http://becker.wustl.edu/impact-assessment>> to better enrich the publication summaries [1].

One of our recent projects involved a request by an awards committee to investigate the work of Jeremiah Stamler, an eminent researcher and clinician in cardiovascular disease epidemiology, and create visualizations to showcase our findings. The committee hoped to highlight the scholar's career achievements and significant contributions to the scholarly literature and to demonstrate the scholar's collaboration with and mentoring of others in this field. Metadata were harvested from open and commercial data aggregators, including Scopus, PubMed, Web of Science, various other online sources, and the scholar's curriculum vita. A wide range of tools and resources—such as Tableau, Excel, Sci2, and Adobe Illustrator—were used to visualize the data.

Visualizations were chosen based on their ease of understanding, relevance to the committee's request, and overall visually appealing nature. Additionally, the librarians explored different visualization tools, noting which visualizations were possible given the available data and the features of the tool. They noted that the tools varied widely in terms of features, cost, and ease of use. Each visualization was accompanied by a short narrative stating the type of visualization, the data source, and the types of conclusions or impacts that could be drawn. A variety of visualizations were presented to the committee at the end of the project, from which they chose the slides to be used for a celebration event for the scholar (Figure 5). Two large posters were also created to further highlight the visualizations.

These visualizations will be part of a larger portfolio of works that the library will provide to users to demonstrate these services. Library staff played a key role in collecting data from the literature databases by providing expert searching skills and knowledge of the limitations of the data and file types available for export.

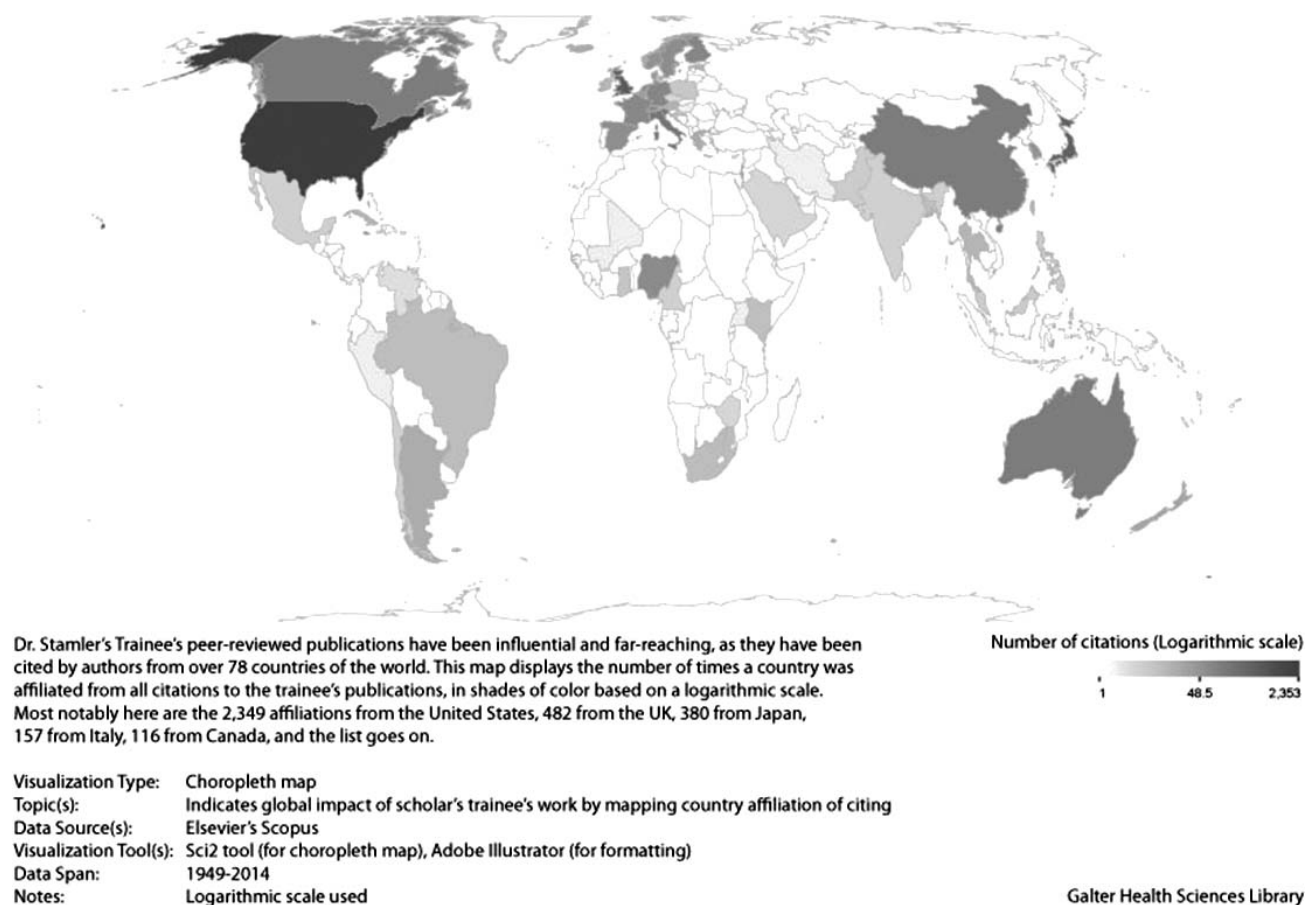
The ability to understand the impact of research and clinical activities in the academic environment is difficult. Today's medical libraries provide resources and expertise to their campuses that can be leveraged to accomplish data analysis and visualizations. Librarians offer the perfect combination of expertise, perspective, and resources to support and advise the assessment and visualization of research impact across the peer-reviewed literature and beyond.

## ACKNOWLEDGMENTS

The project was supported, in part, by the Northwestern University Clinical and Translational Science Institute grant number UL1TR000150 from the National Center for Advancing Translational Sciences <<http://www.ncats.nih.gov>> Clinical and Translational Sciences Award (CTSA). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The CTSA is a registered trademark of the US Department of Health and Human Services.

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**Figure 5**

Visualization: choropleth map depicting Jeremiah Stamler's mentorship

## REFERENCE

1. Sarli CC, Dubinsky EK, Holmes KL. Beyond citation analysis: a model for assessment of research impact. *J Med Lib Assoc.* 2010 Jan;98(1):17–23. DOI: <http://dx.doi.org/10.3163/1536-5050.98.1.008>.

## ANALYZING LIBRARY SERVICES USING CUSTOMER RELATIONSHIP MANAGEMENT DATA AND R PROGRAMMING

**Submitted by V. P. Nagraj; Megan S. Nunemaker, MSLS; University of Virginia**

In late 2013, librarians at the Claude Moore Health Sciences Library (CMHSL) began investigating customer relationship management (CRM) products that would help assess library impact and

connections across University of Virginia Health System constituencies. CRM tools are commonly used by businesses to track customer interactions and can be adapted to a library environment to identify individual team member's activities and service points. After evaluating several CRM products, the library selected Zoho CRM <<http://www.zoho.com/crm/>>. More information regarding the selection process was presented at MLA '14 <<http://libra.virginia.edu/catalog/libra-0a:7298>>.

Information tracked in the Zoho CRM serves three purposes for the CMHSL. First, it replaces an older database that was used to track activities and provide required reporting to the Association of Research Libraries (ARL) and the Association of Academic Health Sciences Libraries (AAHSL). Second, Zoho provides more detailed data collection, allowing CMHSL librarians to track support for

various clinical departments and the overall mission of the University of Virginia Health System: caring for patients, training new physicians, and creating and sharing health knowledge. Third, librarians can use Zoho CRM to capture information that was not previously stored centrally, such as email correspondence and search history, allowing staff to easily review previous patron encounters.

Although Zoho includes data visualization features that meet some basic reporting needs, the CMHSL uses the system primarily for data collection. To further analyze the data and demonstrate how CMHSL activities support the health system mission, library administration worked with web development staff to write custom reports in R statistical programming language. These scripts prepare the data for analysis, produce summary statistics, provide a variety of plotting options, and ultimately output a compiled document in portable document format (PDF). The report includes highly customizable plots that can be configured to represent multiple factors and interactions over time. The code is available on Github <<http://github.com/vpnagraj/cmhsl-crm-analysis>>, as is a sample report <<http://github.com/vpnagraj/cmhsl-crm-analysis/blob/master/hslZohoDataAnalysis.pdf>>.

The combination of the Zoho CRM and R programming leverages the strengths of both tools. Zoho gives CMHSL librarians a well-supported interface to collect data. With R, the library benefits from a nonproprietary statistical computing language that is largely considered the standard for transparency and reproducibility in data analysis. With the click of a button in Zoho and the execution of an R script, the library can have an automated report on liaison engagement. In December 2015, CMHSL administration plans to leverage these tools to draft a comprehensive annual report. Such a reporting mechanism will help demonstrate the library's value to both internal and external entities, including the University of Virginia, regarding patron engagement at a departmental level, distribution of liaison activities, and high-traffic times of the year, among other activities. Such a mechanism can enable the kind of data-driven decision making to which many libraries aspire.

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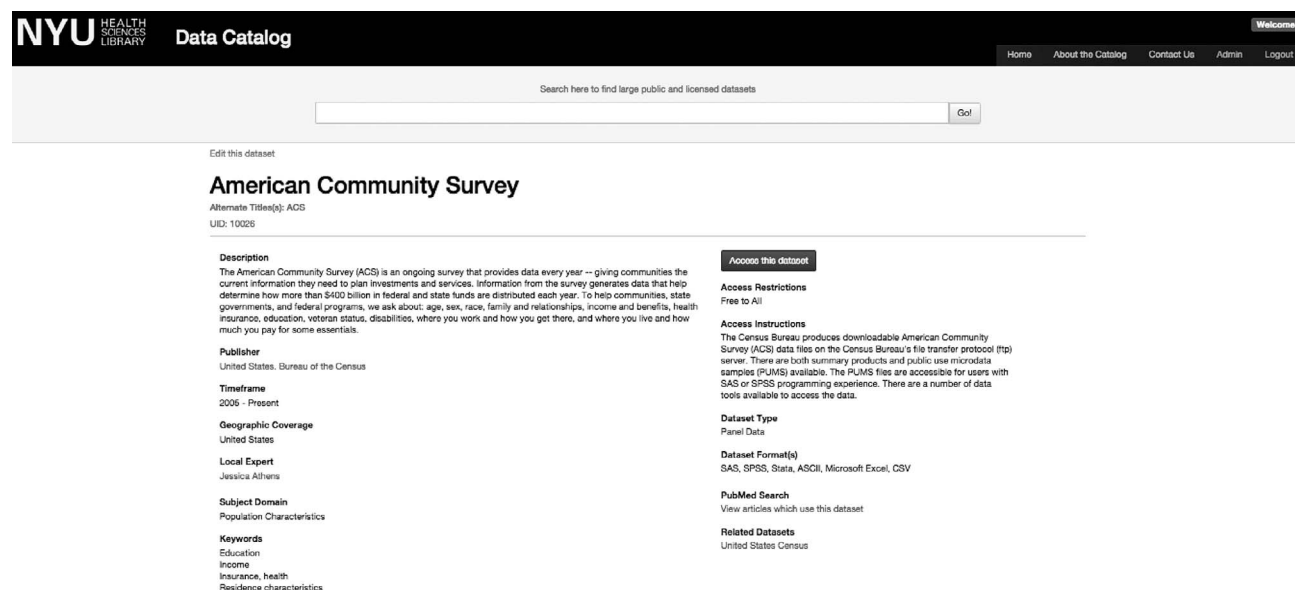
## BUILDING A DATA CATALOG: PROMOTING DATA REUSE AND COLLABORATION AT AN ACADEMIC MEDICAL CENTER

Submitted by Alisa Surkis, PhD, MLS; Kevin Read, MLIS, MAS; Ian Lamb; Jessica Athens, PhD, MS; Joey Nicholson, MLIS, MPH; Sushan Chin, MS, MA; Julia Xu, MD, MS; Karen Hanson, MLIS; Catherine Larson, MS; New York University

The New York University (NYU) Health Sciences Library (HSL) partnered with the Department of Population Health (DPH) at the NYU School of Medicine to create a catalog of large public or licensed external datasets and internal datasets generated by researchers at the institution. The data catalog <<http://datacatalog.med.nyu.edu>> was created in response to the DPH's aim to facilitate research using external datasets and reduce barriers, including difficulty accessing and working with the datasets and lack of knowledge about institutional licenses for these data sets. The planned addition of internal datasets was driven by the library's recognition of an increased focus on data sharing from the institution, funders, and publishers. To encourage usage, the catalog started with a core of external datasets of broad interest. Searches for these external datasets could then lead to the serendipitous discovery of related internal datasets.

The data catalog provides detailed metadata and access instructions (Figure 6). Data description standards from DataCite <<http://schema.datacite.org>>, Dryad <[http://wiki.datadryad.org/Metadata\\_Profile](http://wiki.datadryad.org/Metadata_Profile)>, and the W3C Data Catalog Vocabulary <<http://www.w3.org/TR/vocab-dcat/>> were reviewed to create metadata to facilitate access to both external and internal datasets. Some metadata necessary to describe internal datasets were not applicable to external datasets and vice versa. However, these metadata concerns were outweighed by the strategic advantages of a catalog combining both types of datasets. Metadata elements were added to enhance functionality, including researchers at NYU with external dataset expertise ("Local Experts"), links to PubMed searches of publications on external datasets, and an "Other Resources" element to facilitate expansion of catalog functionality. Examples of "Other Resources" include links to SAS, SPSS, or other programming codes used to produce analysis datasets from large external datasets and links to data dictionaries for internal datasets stored on library servers. Adding internal datasets is seen as an opportunity to raise awareness





**Figure 6**  
New York University Health Sciences Library data catalog

of data management and sharing issues with researchers; however, inclusion in the catalog will not require researchers to provide documentation or preservation strategies for their datasets (e.g., sharing data in a repository or having a data dictionary).

The catalog is written in PHP using a Symfony framework. An Apache Solr search engine supports a search of all metadata fields, as well as sorting and filtering by facets. Approved users can log in to a dataset entry interface with one of two levels of access: “user” and “administrator.” The user status allows researchers to directly enter datasets, but only an administrator has permission to publish datasets. The data are stored in a relational database, so that information related to entities, such as authors or publishers, can be updated independent of the dataset entries in which they are listed. The code is shared on GitHub <<http://github.com>>, a web-based repository for sharing and editing software.

The catalog is currently linked to from the NYU HSL, DPH, and NYU Clinical and Translational Science Institute websites, with plans to embed links in other relevant websites at the medical center and other NYU schools. There are also plans to include data catalog entries in the main library catalog. Initial targeted outreach has resulted in the addition of new external datasets and local experts, suggestions for improvements, and interest from researchers in including their internal datasets in the

catalog. Despite limited outreach, the data catalog has had almost 600 unique page views in the 6 months since it went live. The data catalog has also led to a partnership with the medical center’s DataCore, a centralized data services group. The data catalog adds a discovery layer to and complements DataCore plans to provide storage and access to analysis datasets from both clinical research projects and electronic health record data. Additionally, there are plans to partner with data librarians from the main university library to identify and describe relevant internal datasets from the main campus.

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## ENABLING 3D PRINTING APPLICATIONS FOR HEALTH CARE IN A UNIVERSITY LIBRARY

**Submitted by Melinda Johnson, MLIS; John Reynolds, MLIS; Kristin Kroger, MLIS, AHIP; Majid Anwar, MLIS, AHIP; Nova Southeastern University**

The Health Professions Division Library at Nova Southeastern University (NSU) <<http://www.nova.edu/hpdlibrary>>, supporting seven health professions colleges (osteopathic medicine,

pharmacy, dentistry, optometry, health care sciences, nursing, and medical sciences), is the ideal place for encouraging interdisciplinary collaboration and medical innovation. Due to the rapid growth of 3D printing applications in health care in the past few years, the library wanted to expose students to the huge potential that 3D printing presents to the medical community and give them a hands-on opportunity to create medical applications while collaborating with fellow students and faculty.

Our leap into 3D printing technology began by visiting local libraries with 3D printing services, researching existing programs in academic libraries, and reviewing 3D printing applications in health care in the literature. In collaboration with the Broward County Library <<http://www.broward.org/library>>, the local public library with experience and expertise in providing 3D printing and makerspace services, the Broward and NSU librarians gave a demonstration and overview of 3D printing to the faculty. Because of the positive feedback and specific project ideas that were received from this presentation, the library launched a 3D printing initiative in December 2014.

Based on this background research, the library started the new service with a basic printer from a company that provided reliable technical support, MakerBot Replicator <<http://www.makerbot.com>>, which creates objects from digital files by applying successive layers of polylactic acid (PLA) filament, a biodegradable corn-based plastic. After initial testing, the printer was placed in a prominent location in the library, so everyone could see it working. A faculty email discussion list and a LibGuide were created to share information and updates. The goal was to inspire innovative medical applications, so print requests were restricted to research, education, and clinical care, with no charge for printing.

Our first project was partnering with occupational therapy faculty and students to print prosthetic hands for children. We discovered print files for prosthetic devices for children on the National Institutes of Health (NIH) 3D Print Exchange <<http://3dprint.nih.gov>>, an open-source, curated collection of 3D biomedical print files. We

successfully printed the Raptor Reloaded hand <<http://enablingthefuture.org/upper-limb-prosthetics/raptor-reloaded/>> that was developed by e-NABLE <<http://enablingthefuture.org>>, a not-for-profit organization that develops open-source prosthetic designs and matches owners of 3D printers with children in need. As a result of this project, NSU registered with e-NABLE as a volunteer supplier of prosthetic devices, and an occupational therapy professor and six students will conduct a research study in August 2015 on local children's performance using the Raptor Reloaded hand. The library has also printed an inner ear model for use in audiology classes and a series of skulls and mandibles made from computed tomography (CT) scans of patients for residents in the NSU Oral Maxillofacial Surgery Program to use in the operating room for trauma and facial reconstruction.

Our initiative provided several challenges, most of them technical. After several repairs and the installation of replacement parts, the printer is now working efficiently. To help create, modify, and improve print files, we have had to learn and use different 3D software. Each print project has taught us something valuable, leading to adjustments in the software, hardware, and materials as we went along. For example, the length of time to print the projects, some ranging between fifteen to thirty hours, has been a surprise.

Informal discussions with faculty and students revealed that they had never considered using this technology until they saw it in action in the library. We wanted to inspire interest and creativity, and it has worked. We currently have a waiting list due to long printing times and requests for multiple objects. Our future plans include adding a 3D scanner and a second printer with alternative printing options to support whatever projects faculty and students might imagine, such as using flexible and see-through materials to create more lifelike anatomical models.

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